

Sump Design Considerations for Irrigation Pumps

Introduction

The sump and intake structure is perhaps the most important element of the pump station. Unless it is properly located, designed and sized, the flow conditions within could have an adverse effect on the performance of the pump.

Sump Configuration

Many variations in sump arrangements are acceptable; however best results are obtained when the sumps or sump bays are oriented parallel to the line of flow. Flows approaching from an angle create dead spots and high local velocities, which result in vortices, nonuniform entrance velocities, and an increase in entrance head losses. The flow to any pump should not be required to pass another pump. When sumps or sump bays are perpendicular to the direction of flow, such as intake from a canal, the distance between the entrance to the sump and the pump must be sufficient for the flow to straighten itself out before reaching the pump.

The sump inlet should be below the minimum water level. The water should not jet directly into the pump inlet, or enter the pit in such a way as to cause rotation of water in the pit. Where required, baffles can be incorporated into the design to control jetting rotation.

Intake Submergence

The amount of submergence required for successful operation depends greatly on how the water approaches the pump. The capacity of the pump and size of the intake bell also affects minimum requirements. If there is a screen bolted to the pump intake, then adequate depth below the bell must be allowed for removal of the screen.

Other Considerations

In addition to the general design principles outlined above, the following factors are important to design:

In most situations, trash screens will be needed to eliminate debris from entering the pump suction. Ideally, a double screening arrangement should be installed at the sump inlet for open sumps or at the pipe inlet for closed sumps. Meshes with openings $\frac{1}{8}$ to $\frac{1}{4}$ inch in size are typical, although finer screening may be used in some instances.

Adequate space and provision should be allowed for raising or removal of the screens for cleaning.

Secure mounting should be provided for bolting vertical turbines in place. As a safety precaution the sump should be covered but with access for maintenance and silt cleaning.

Special considerations must be given for sumps adjacent to rivers or reservoirs to protect them from both erosion and ice damage. When prefabricated sumps are used one should not overlook the need for proper bedding and compaction to insure stability.

Recommendations for critical dimensions from various manufacturers, technical articles and the Hydraulics Institute Standards are summarized in Figures 1 and 2. These dimensions generally apply to both vertical turbine pumps and sumps for suction intakes of vertical or horizontally mounted centrifugals.

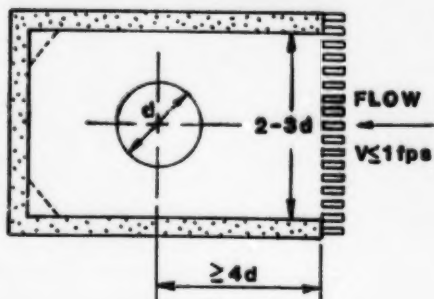
It should be noted that the dimensions are relevant to the hydraulic aspects of the sump. In addition, structural design will have to be done for the specific site and pump particulars.

For more information contact an Alberta Agriculture irrigation specialist. They are located at Lethbridge, Taber, Bow Island, Medicine Hat, Brooks, Vauxhall, Airdrie and Strathmore.

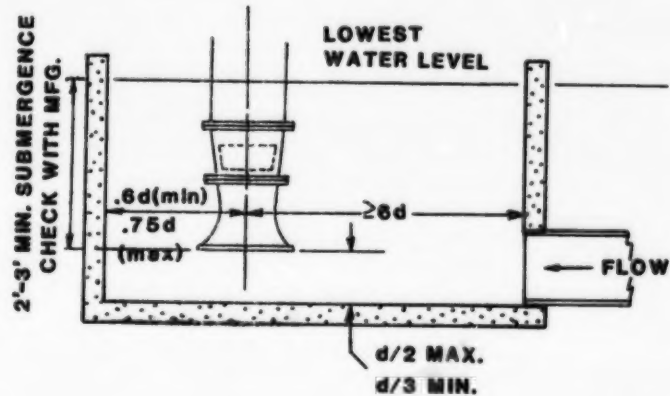
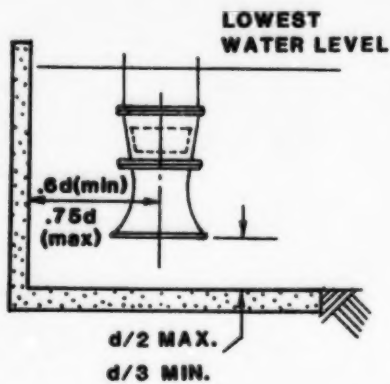
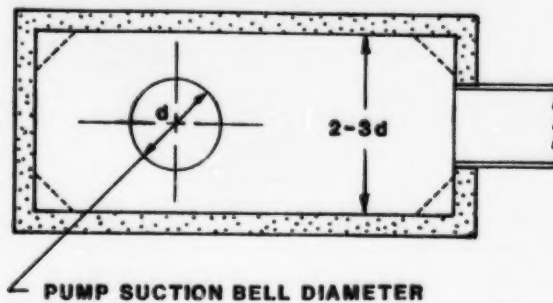
Figure 1. Vertical Turbine Pumps Single Sump Design

SINGLE SUMP DESIGN

(a) OPEN SUMP

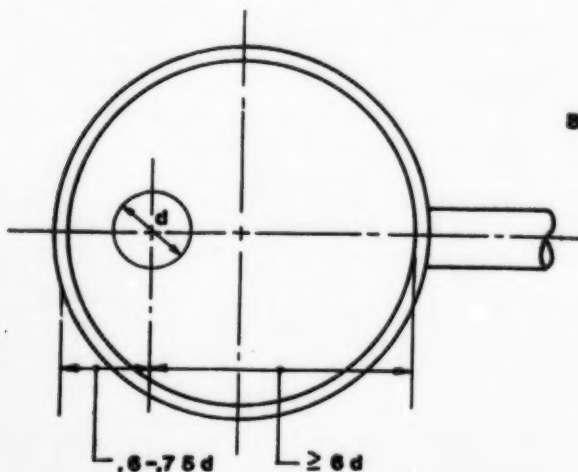


(b) ENCLOSED SUMP



CIRCULAR SUMPS

(a) SINGLE PUMP



(b) DOUBLE PUMP

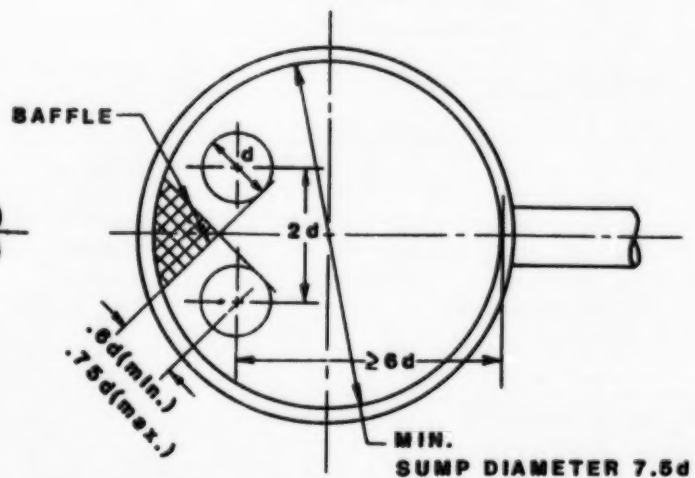
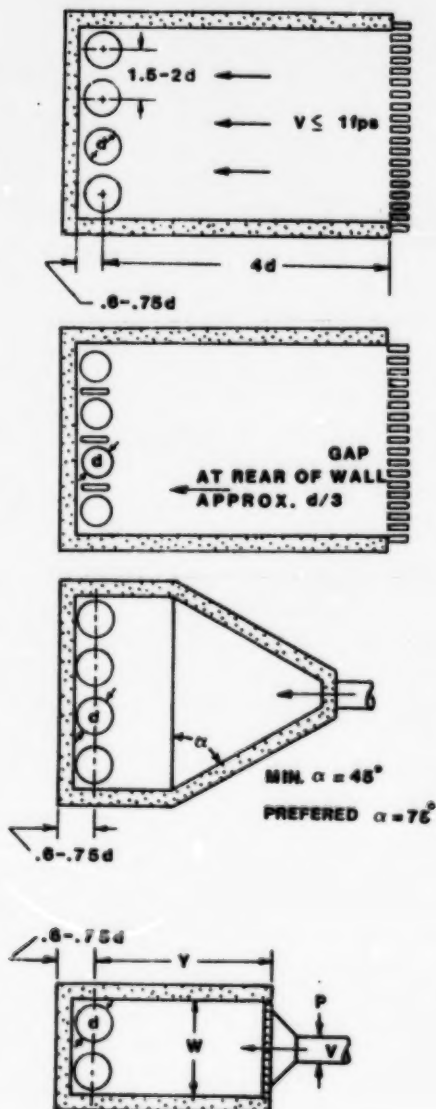


Figure 2. Vertical Turbine Pump Multiple Sump Design

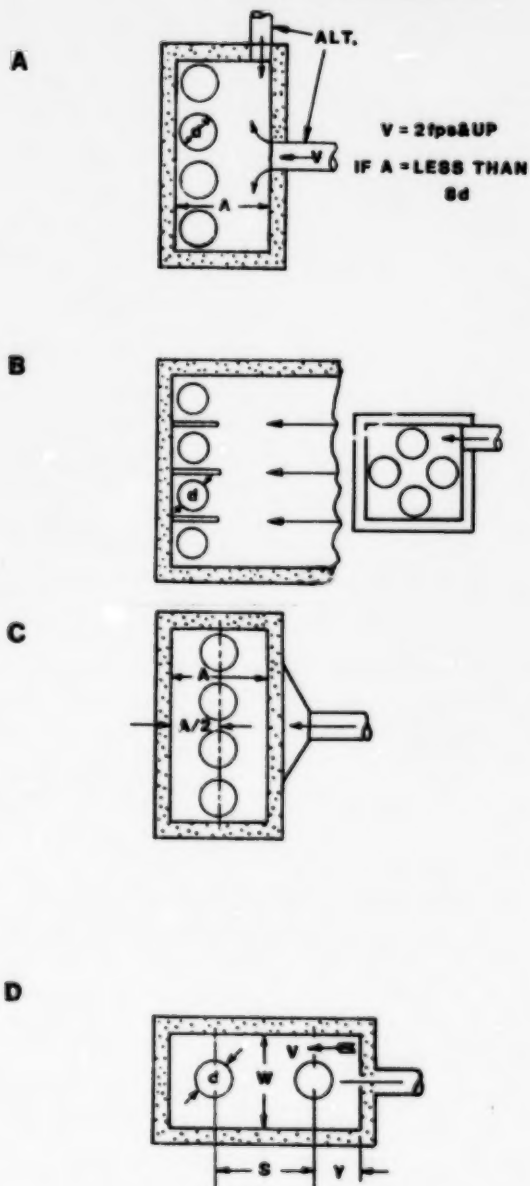
RECOMMENDED



BAFFLES GRATING OR STRAINER SHOULD BE INTRODUCED ACROSS INLET CHANNEL AT BEGINNING OF MAXIMUM WIDTH SECTION.

W/P	1.0	1.5	2.5	4.0	10.0
Y	3d	5d	8d	10d	15d
V _p	1	2	4	6	8

NOT RECOMMENDED



NOT RECOMMENDED UNLESS:

W = 5d OR MORE, OR
V = 0.2fps OR LESS AND
Y = SAME AS CHART TO LEFT
S = IS GREATER THAN 4d